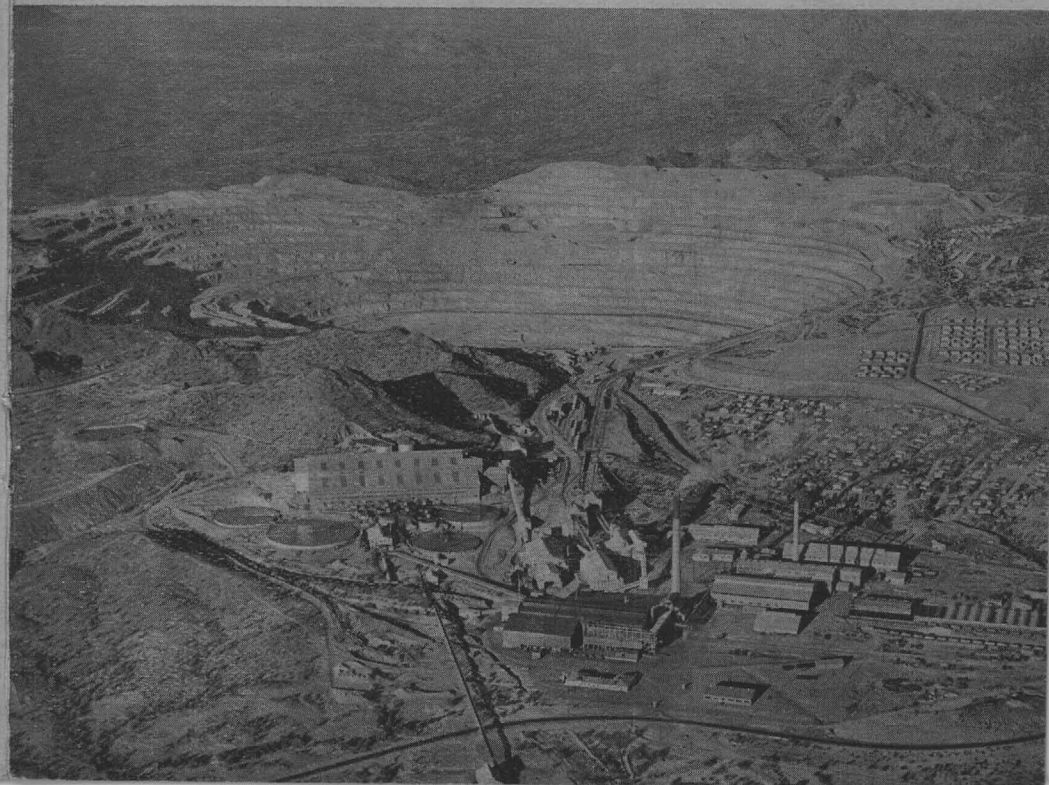


MINING IN ARIZONA

Its Past - Its Present - Its Future

ARIZONA DEPARTMENT OF MINERAL RESOURCES



**DEPARTMENT OF MINERAL RESOURCES
STATE OF ARIZONA
PHOENIX, ARIZONA**

**FRANK P. KNIGHT, DIRECTOR
FRANK J. TUCK, STATISTICAL ENGINEER**



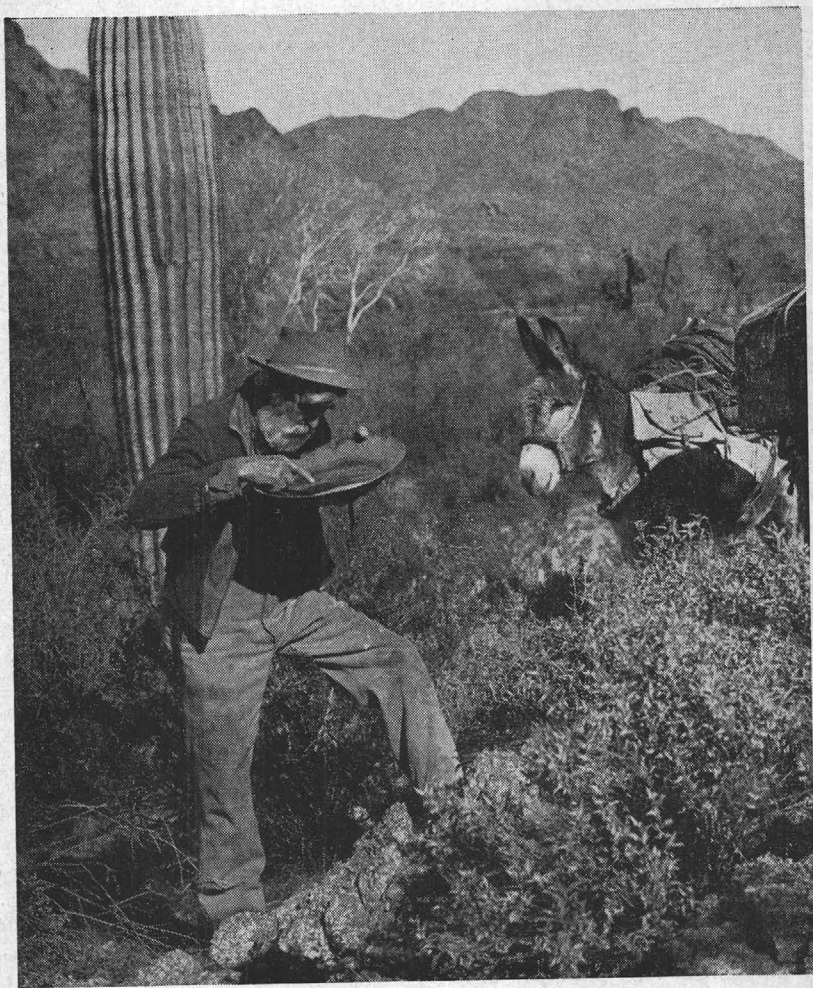
MINING IN ARIZONA

Its Past

Its Present

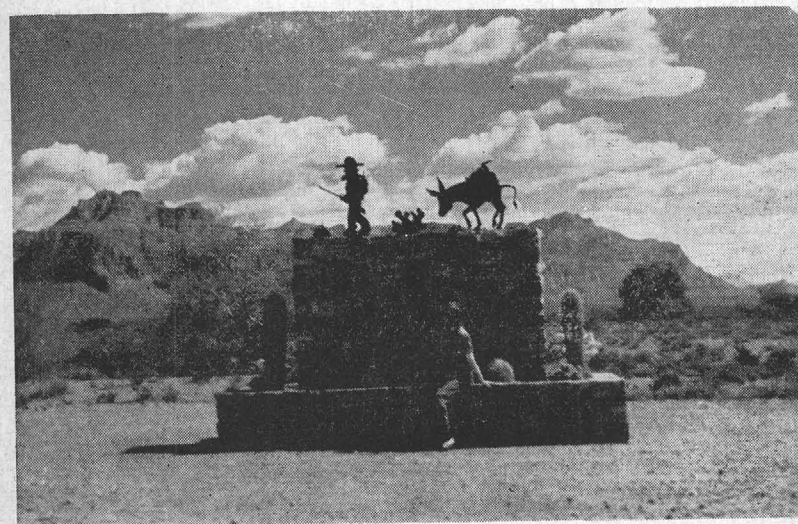
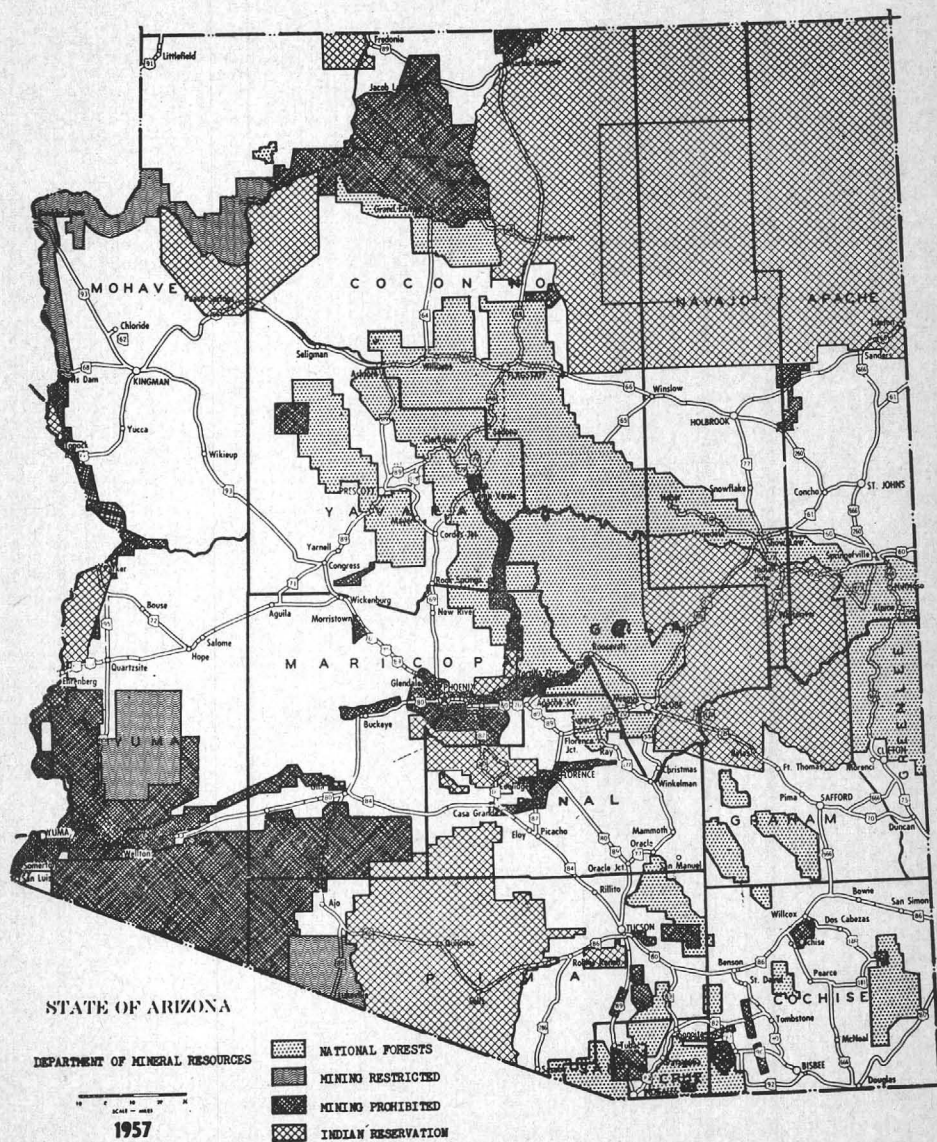
Its Future

APRIL, 1961



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Superstition Mountain Monument

PALMER PRtg. CO., PHOENIX, ARIZ.



TABLE IX

MINERAL PRODUCTION OF LARGE AND SMALL PRODUCERS IN ARIZONA IN 1959*

LARGE COPPER PRODUCERS ¹		PRODUCTION	VALUE
Copper (lbs.)	841,153,000		\$258,234,000
Gold (ozs.)	100,000		3,500,000
Silver (ozs.)	2,850,000		2,579,000
Molybdenum (lbs.) (content of concentrate)	3,181,000		4,019,000
Total Value of Large Mine Production in 1959			\$268,332,000
SMALL MINERAL PRODUCERS:			
Clays ² (short tons)	120,000	\$	179,000
Coal (short tons)	7,000		63,000
Copper (recoverable content of ores, etc.) (lbs.) ..	19,441,000		5,968,000
Gem stones	(4)		88,000
Gold (recoverable content of ores, etc.) (troy ozs.)	24,627		862,000
Lead (recoverable content of ores, etc.) (lbs.) ..	19,998,000		2,300,000
Lime (short tons)	123,000		1,666,000
Manganese ore and concentrate (35% or more Mn) (gross wt.) (short tons)	68,183		5,727,000
Manganiferous ore and concentrates (5-35% Mn) (gross short tons)	10,693		234,000
Mercury (76-lb. flasks)	(3)		(3)
Mica (scrap) (short tons)	3,069		55,000
Pumice (short tons)	487,000		1,153,000
Sand and Gravel (short tons)	13,458,000		11,966,000
Silver (recoverable content of ores, etc.) (troy ozs.)	1,048,000		949,000
Stone (short tons)	2,468,000		3,998,000
Uranium Ore (short tons)	253,390		6,309,000
Zinc (recoverable content of ores, etc.) (lbs.)	74,650,000		8,585,000
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite), feldspar gypsum, perlite, pyrites, petroleum, vanadium, and values indicated by footnote 3			9,837,000
Total Value of Small Mine Production ³		\$	58,556,000
GRAND TOTAL VALUE OF MINERAL PRODUCTION			\$326,888,000
PERCENTAGE DUE TO SMALL MINES			17.91%

FOOTNOTES:

1. Phelps Dodge, Kennecott, Inspiration, Miami, Magma, A.S.&R.Co's Silver Bell, Pima, Bagdad and Duval's Esperanza.

2. Excludes bentonite; value included with "Items that cannot be disclosed."

3. Figure withheld to avoid disclosing individual company confidential data; value included with "Items that cannot be disclosed".

4. Weight not recorded.

5. Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement and lime.

*Compiled from U. S. B. M. Area Report D-106, July 1960—Final Figures 1959.

Mining In Arizona

Arizona is by far the greatest producer of non-ferrous, metallic minerals of any state in our Union. In 1960,

It ranked first in the combined dollar value of such metals.

It ranked first in copper production.

It ranked fourth among western states in lead.

It ranked second among western states in zinc.

It ranked second among all states in silver.

It ranked fourth among all states, including Alaska, in gold.

The following is a tabulation of the total Arizona production of these metals.

TABLE I

	Gold oz.	Silver oz.	Copper lbs.	Lead lbs.	Zinc lbs.
1950	118,313	5,325,441	806,602,000	52,766,000	120,960,000
1951	116,093	5,120,985	831,740,000	34,788,000	105,998,000
1952	112,355	4,701,330	791,438,000	33,040,000	94,286,000
1953	112,824	4,351,429	787,050,000	18,856,000	55,060,000
1954	114,809	4,298,811	755,854,000	16,770,000	42,922,000
1955	127,616	4,634,179	908,210,000	19,634,000	45,368,000
1956	146,110	5,179,185	1,011,816,000	23,998,000	51,160,000
1957	152,499	5,279,323	1,031,708,000	24,882,000	67,810,000
1958	142,979	4,684,580	971,678,000	23,780,000	57,064,000
1959	124,627	3,898,336	860,594,000	19,998,000	74,650,000
1960 P	145,600	4,751,000	1,080,000,000	17,200,000	72,600,000

P = Preliminary

HISTORY — General

In the period from 1858 to 1960 inclusive, Arizona's mines have yielded more than \$8 billion, over 95% of which came from its five principal metals: copper, lead, zinc, gold and silver. While all phases of the mining industry contributed to such achievement, it is to the pioneer prospector and miner we owe of this "machine age" owe an everlasting debt. He first found the veins and the ore-bodies. He blazed the trails, conquered the desert, braved its terrors, bridged the barrenness, scaled its difficulties and, in the end, wrested wealth from its age-long secrets and its hidden hoards.

Long before the white man had set foot on much of this nation's area he had explored portions of Arizona. It was the lure of the metals—gold and silver—that prompted Coronado's famous expedition in search of the Seven Cities of Cibola, and in 1540, eighty years before the Mayflower left England, Coronado's Army Captain, Cardenas, stood on the brink of Arizona's Grand Canyon. Coronado, however, wanted his gold and silver already mined, smelted and minted. Consequently, he did no prospecting.

In 1583, thirty-seven years before the landing of the Pilgrim Fathers, a white man, Antonio Espejo, found silver ore in what is now Arizona. It was Arizona's first recorded mineral discovery. It is known that the Indians did little mining except for turquoise, salt, and possibly iron oxide for paint.

There appears to have been little prospecting following Espejo's discovery until about 1705, when Father Kino did some silver mining. About 1736, the rich silver deposits, Planches de Plata, near the site of Nogales, stimulated mining, and in 1769, when Tucson became a Spanish settlement, it is known that the Spaniards mined gold and silver in the region. Gold placers at Quijotoa are said to have been worked in 1774.

From about 1824 to 1842, much of Arizona was covered by American trappers and explorers, among them Bill Williams, Pauline Weaver and Kit Carson. Apache raids prevented settlement and

The preliminary population figures by Counties, for 1960, were as follows:

Apache	30,438	Mohave	7,736
Cochise	55,039	Navajo	37,994
Coconino	41,857	Pima	265,660
Gila	25,745	Pinal	62,673
Graham	14,045	Santa Cruz	10,808
Greenlee	11,509	Yavapai	28,912
Maricopa	663,510	Yuma	46,235

TABLE VIII

VALUE OF MINERAL PRODUCTION IN ARIZONA, BY COUNTIES

County	YEARS 1955-56-57-58-59				Source: U.S.B.M. YEARBOOK	
	1955 ¹	1956	1957	1958	1959	
Apache	\$ 731,066	\$ 3,691,829	\$ 3,164,474	\$ 4,324,954	\$ 4,233,943	
Cochise	49,677,664	68,344,376	50,474,007	38,065,293	31,963,199	
Coconino	64,045	1,884,705	2,864,384	4,394,124	4,884,107	
Gila	66,684,347	76,785,677	50,935,723	43,124,640	50,239,827	
Graham	674,745	531,609	290,079	20,402	153,582	
Greenlee	95,328,130	111,374,672	67,052,744	53,073,897	48,084,455	
Maricopa	3,315,210	3,959,377	6,206,000	5,370,894	6,698,542	
Mohave	427,067	1,873,189	911,628	950,678	982,759	
Navajo	104,443	793,823	1,495,443	2,253,126	3,170,572	
Pima	82,748,688	91,431,712	75,739,870	66,089,879	91,324,508	
Pinal	56,209,900	101,723,680	87,710,021	78,450,806	61,236,788	
Santa Cruz	2,324,005	2,929,900	2,491,068	1,266,720	1,130,477	
Yavapai	16,510,609	16,064,018	18,254,158	16,399,450	21,643,699	
Yuma	99,088	331,363	1,117,509	1,652,166	1,794,254	
Undistributed ²	4,332,066	4,344,641	5,230,422	288,528	682,697	
TOTAL ³	\$378,277,000	\$484,959,000	\$372,641,000	\$314,520,000	\$326,888,000	

1. Excludes value of manganese ore sold and blended at Gov't low-grade stockpiles for future beneficiation.

2. Includes sand and gravel, vanadium, stone, gemstones, natural gas and uranium.

3. Total has been adjusted to eliminate duplication in the value of raw materials used in the manufacture of cement and lime.

To a tourist in good health, and accompanied by an experienced prospector, the search for a "lost" mine is a healthful and interesting diversion during the winter months. Such trips always have the possibility of discovering some overlooked mineralized out-crop of promise; a neglected, rather than a "lost" mine.

ARIZONA FACTS

The word "Arizona" is believed to have been derived from two Indian languages—Papago and Pima—and means "Little Spring". "Ari" means small and "Zonac" spring.

Arizona is the 48th state admitted to the Union, the sixth largest, and has an area of 113,956 square miles. The State was organized as a territory in 1863, and was admitted to the Union on February 14, 1912.

The State flag represents the copper star of Arizona rising from a blue field in the face of a setting sun. The lower half is a blue field, the upper half is divided into 13 equal rays which start at the center and continue to the edges of the flag, consisting of six yellow and seven red rays. A five pointed copper star is superimposed on the center of the flag.

Arizona's state bird, the tiny cactus wren, likes to build his home in the protection of thorny desert plants. Because of this he often builds his nest in the arms of the giant sahuaro cactus. He builds several nests but lives in only one—the rest are decoys. He is a woody brown bird with a speckled breast.

The State flower is the pure white waxy flower of the sahuaro cactus, which blooms in the late spring. Blooms are found on the tips of the sahuaro arms. Many sahuaros are more than 100 years old and they often attain a height of 50 feet.

Arizona population in 1960 was reported to be 1,302,161, 73.7 percent higher than the census figure for 1950. It is the nation's fastest growing state since the start of the century. In 1900, Arizona's population was 122,931.

prospecting, however, until well after 1848, when that portion of Arizona north of the Gila River became part of the United States. That was also the year of the California gold rush, and while thousands of emigrants crossed Arizona enroute to the "gold diggings," few stopped to prospect. There are, nevertheless, well authenticated stories that Papago Indians had discovered gold near Gila City, Yuma County, in 1846, or two years prior to the California discovery.

Following the Gadsden Purchase in 1854, southern Arizona was actively prospected. In that year claims were located at Ajo. Mines were worked at Cerro Colorado, and in the Santa Rita Mountains south of Tucson. A few years later the Mowry mine was shipping rich lead ore. With the outbreak of the Civil War in 1861, and withdrawal of U. S. soldiers, the Apaches "took over" for some 10 years. Nevertheless, in 1862-63 the rich, gold placers of La Paz, Rich Hill and Lynx Creek were found and mined, and soldiers stationed at Fort Mohave discovered gold lodes near what is now Oatman. It was about that time, too, that many famous mines were discovered—Vulture, Planet, Castle Dome, and many of the rich mines of the Prescott region.

The '70's witnessed the discovery and development of many Arizona mining camps that are still yielding great mineral wealth. Globe-Miami, Silver King, Superior, Bisbee, Jerome, Tombstone, and Clifton-Morenci are among the mining districts founded in that period.

All these camps etched for themselves colorful pages in Arizona's early history, but perhaps the once-riotous Tombstone succeeded in leaving the most indelible impression.

"Instead of a mine, you'll find a tombstone," said a fellow soldier to Ed Schieffelin in 1877 as he set out from Fort Huachuca, near the Mexican border, to "look for stones." Schieffelin recalled the warning, and when he came across some rich appearing ore, said to himself, "Here is my tombstone." That was how the camp received its name. Since then stories of its development, its frontier sheriffs who brought law and order to one of the wildest mining camps of the then very wild West, and its rugged inhabitants, have been the subject of a number of articles and books.

Untold centuries ago there was locked away in Arizona's mighty mountain vaults, stores of precious metals; a supply sufficient and necessary for our increased commerce, industry and population. The doors of these vaults were fitted with time locks. Those already opened have given the world rich treasures. Others as yet unlocked await but the same combination—need, capital, science, brains, courage, faith, and work.

Table II is a summarized tabulation of Arizona's production of its five principal metals to the end of 1960:

TABLE II

17,197,000 tons of copper	worth	\$6,721,464,000
609,000 tons of lead	worth	118,526,000
851,000 tons of zinc	worth	205,998,000
12,596,000 ounces of gold	worth	328,365,000
359,290,000 ounces of silver	worth	277,543,000
Total Value		\$7,651,896,000

And that isn't all of the story. It is estimated that fifty percent of the value of all of these metals has been expended in Arizona for wages, supplies, and state, county, city and school taxes. The balance has gone for out-of-state purchases, refining, marketing, and dividends to investors, many of the latter being citizens of Arizona.

many out-of-print U. S. Geological Survey and U. S. Bureau of Mines publications, all very valuable for reference. Technical trade journals, late information on pending legislation, market and price data, and other pertinent mining information are on file.

The Mineral Building, finished in 1919, houses a fine collection of minerals. For many years this valuable display was open to the public only during the 10-day period of the Arizona State Fair in November of each year. Early in 1953, the following mining companies provided funds to keep the exhibit open on a year round basis with a curator and assistant: American Smelting and Refining Company, Inspiration Consolidated Copper Company, Kennecott Copper Corporation, Magma Copper Company, Miami Copper Company, and Phelps-Dodge Corporation. The Mineral Museum is under the direction of the Department. Besides the minerals in the display, there is a fine collection of almost every type of rock found in Arizona. The Museum is valuable for study purposes as well as interesting and informative to visitors, regardless of their interest in mining as an industry.

"LOST" MINES

Arizona is rich in legends of many "lost" mines.

Perhaps 98 percent of the "lost" mines are pure fiction. They exist only in imagination. True, the stories are interesting, especially to new-comers, but they are likewise dangerous. Many lives have been lost searching for these mythical mines, and in addition, the communities are put to extra expense for posses and searching parties.

"Don't believe" is sound advice regarding lost mines. Forget the lost mines shown on the "old-map-my-grandfather-bought-from-an-old-Spaniard-he-befriended." It simply doesn't exist. The map is probably a fake, regardless of crude lettering, old and soiled paper, or other details which would seem to lend authenticity.

The rich ore that is supposed to have been obtained from a "lost" mine—and some were very rich—in all probability was "high-graded" (stolen) from some of the early day rich mines then working.

geology and mining history of most Arizona mining districts. Many valuable bulletins, maps and pamphlets may be obtained free of charge.

An organization known as the Arizona Small Mine Operators Association, 508 Title and Trust Building, Phoenix, Arizona, furnishes many valuable services. Those interested in mining are advised to join. Dues are only \$1.00 per year, including a subscription to its monthly publication, which disseminates mining news and information.

Mining conditions change. New facts are discovered each day in the advancement of mining and metallurgical technology. Today's waste rocks will be tomorrow's ore, and the demand for the metals will continue to mount.

ARIZONA DEPARTMENT OF MINERAL RESOURCES

This department, with offices in the Mineral Building at the Fairgrounds in Phoenix, is a state agency established to assist the more extensive exploration and development of the mineral resources of the State. The department engineers render assistance within the limitations of their public position. The department's files contain information on many properties and its library includes



Mineral Building, Fairground

THE MAJOR METALS

The five major metals being produced in Arizona are gold, silver, copper, lead and zinc.

GOLD AND SILVER

Gold mining in Arizona did not start to any appreciable extent until after the acquisition of the territory by the United States from Mexico in 1848 and 1853.

In 1853, the only accessible parts of the Territory were around Tucson and Tubac, where several silver mines and one copper mine were opened, but little or no mining was done. The outbreak of the Civil War caused the withdrawal of troops and all mining ceased.

During the Civil War, troops came back and prospecting parties were organized. Rich placer gold deposits were found near the Colorado River at Gila City, La Paz, Quartzsite, and Rich Hill, and along Lynx Creek, Hassayampa River, and Big Bug Creek in the Bradshaw Mountains of Central Arizona. After the richer parts of the placers were exhausted, gold ledges were located and worked in the crudest manner.¹ The Vulture was the only large mine worked.

After the Civil War, troops were again withdrawn, and with the Apaches again rampant, little mining was done except around Prescott and Wickenburg. Peace was made in 1872, but with commodity prices high, gold was less attractive than silver and copper. A silver boom followed and rich mines in the Bradshaws, Silver King, Globe and Tucson areas were discovered. The purchasing power of gold increased during 1884 to 1893 when silver de-monetization stopped practically all silver mining. The silver miners turned to the search for gold, and discovered the Congress and Octave deposits in the Bradshaw Mountains, the Mammoth,

1. J. B. Tenney, Ariz. Bureau of Mines Bull. 137, p. 16, Aug. 15, 1934.

north of Tucson, the rich Harqua Hala, La Fortuna, and King of Arizona mines in the desert of Yuma County, and numerous others. Better concentration methods and the cyaniding process encouraged the reopening of old mines.

Commodity prices turned upward near the close of the century, gold mining again became less attractive and, except for short periods, stayed so until the start of the depression in 1929. However, the rich vein deposits of the Gold Road, Tom Reed, United Eastern, and others in the Oatman district and the older mines of the Bradshaw Mountains and Yuma County were producing—the latter on a reduced scale except for the North Star Mine. The Commonwealth silver mine also produced.

The depression of the Thirties caused a return to active gold prospecting. \$35.00 gold in 1933 further stimulated the search and there was activity in most of the old gold camps and some new. Activity slowed some, as commodity prices rose following the depression, and stopped with the World War II order L-208 closing all gold mines because of labor shortage.

Before the advent of the big porphyry copper producers in 1912, the gold lode mines and placers were accounting for 75 percent of gold production in Arizona. From 1912 until 1942, the gold mines and placers still accounted for almost half of Arizona's gold production, but since then, production from gold lode mines and placers has dropped to below 3 percent of the total. In 1942 the annual production from these mines had dropped from 156,000 ounces to a mere trickle of 1,000 ounces, a loss of 155,000 ounces, or almost five and one-half million dollars. The loss in silver was over 1,050,000 ounces, which had a value (including seignorage) of almost one and one-half million dollars. Although the gold mines were permitted to re-open after World War II, the deterioration of the mines, due to the long shut-down, and the rapid increase in mining costs together with the rapid decline in the purchasing power of the dollar, prevented their doing so. Today there is not one bona-fide gold or gold-silver mine in operation in Arizona, except for the few producing siliceous fluxing ores for the copper smelters. Because of the federal government's control of both gold and silver prices, the producers have not enjoyed the inflationary

THE FUTURE AND ARIZONA'S MINERALS

Arizona is not a "mined-out state". Not all of our ore deposits have been found. In recent years some ore bodies of great promise have been fully investigated and developed under modern exploration, mining and recovery methods. Recent research and exploration results promise further substantial additions to Arizona's copper production.

Only 4 percent of the State's 72,688,000 acres have been intensively prospected, and perhaps less than 1 percent have been investigated by geophysical methods. In addition, many marginal areas in the older and productive districts will yield mineral wealth in the future. There still are productive possibilities in many long-shut-down mines; and many oxide ores not now economical will become so when ways to treat them are found.

The undeveloped ore bodies may not be as rich as those already mined, but the lower grade may be offset by greater tonnage. And with the application of advanced mining and metallurgical practices they may offer rich rewards for venture capital. However, laws, regulations and taxes should be considered carefully in the light of the need of Arizona and the Nation for maintained production and for new mines to take the place of those becoming depleted. Industrial demands must be met, and the nation's security and economic health must be protected.

Arizona seeks and welcomes new mining venture capital. To investors we say, "investigate before venturing", because mining is a highly specialized industry; requires special know-how; and usually involves more risk than trade or manufacturing. Those entering the mining business need the best available advice about the risks involved and the chances of profit to justify the venture.

Investors in mining now have several advantages over early-day venture capital. Legally, they are much better protected in their investments. Technically, they can enlist the aid of the Arizona State Department of Mineral Resources, the Arizona Bureau of Mines, the United States Geological Survey, and the Federal Bureau of Mines. These agencies can and will furnish data as to the

A large cement plant near Tucson has manufactured cement for many years, and until 1959 was the only cement company operating in Arizona. Recently, however, a large plant has been located at Clarkdale, and it is now engaged in shipping enormous quantities of cement to the new Glen Canyon Dam being built on the Colorado River at Page.

MINERAL FUELS

Coal production to the amount of 5,000 to 10,000 short tons annually has been coming for several years from 2 mines in the Indian Reservation, in Coconino and Navajo Counties.

The year 1959 was probably the most significant in the history of oil and gas in Arizona. Twenty-seven wells were completed compared with 19 in 1958. Of the 27 completed wells, 25 were exploratory and 2 were development. Two exploratory wells, both in Apache County, were listed as discoveries, one an oil well and the other gas. The oil discovery, 8 miles south of the Boundary Butte field in Utah, produced 240 barrels of oil a day from Mississippian formations at a depth of 5,566-5,589 feet. One successful development well, an extension of the East Boundary Butte field, was completed in Pennsylvanian formations and produced 104 barrels of oil and 774 thousand cubic feet of gas a day. The gas well was 4 miles west of the Bita Peak field and flowed at 4 million cubic feet a day from the Hermosa (Pennsylvanian) formation at a depth of 4,999-5,071 feet.

Production of crude petroleum, all from Apache County, increased in 1960 more than threefold over 1959. Drilling activity increased with 32 wells completed in the first 10 months compared with 24 for the same period in 1959. At the end of October two rotary drills were active compared with one in 1959.

HELIUM

Interest in the helium wells in northeastern Apache County was heightened by passage by the 86th Congress of the helium conservation bill. The measure encourages production of helium from natural gas by private industry. A number of wells drilled in recent years in the Pinta Dome field contain significant quantities of helium. All have been shut in.

benefits which other commodities have enjoyed. Result, there has been no incentive for them to re-open their old gold mines or explore for new ones. The high rate of out-flow of gold from the United States in 1960 raised the hopes of gold miners that there would be an early return to economic conditions favoring gold mining.

For each ton of Arizona copper ore mined in 1959, \$0.109 in gold and silver were recovered. This gold and silver content tends to decrease, as does the copper, with deeper ores. For example, the value of the gold and silver recovered from copper ores in 1941 was \$0.354 per ton of ore mined. For each ton of copper ore mined in 1941, 0.0059 ounces of gold and 0.207 ounces of silver were recovered, and in 1959 these figures dropped to 0.0018 ounces and 0.051 ounces respectively.

COPPER

For more than 80 years the copper mines of Arizona have poured a ceaseless stream of metal into the nation's industries. The state has for 50 years ranked as the leading copper producer in the United States, its output, up to the end of 1960, amounting to 17,197,000 tons of copper worth \$6,721,464,000. There is no reason to believe that she cannot continue as the leader for many years to come. Nature has made her one of the world's most important sources of copper.

The record of Arizona's steady growth and progress is closely linked with the development of her copper industry. This development has been achieved through decades of courageous perseverance in the face of repeated discouragements. Thousands have spent a lifetime in helping to develop the mines and to build the communities with their schools, banks, churches, public buildings, and their roots extend down into the earth, to the bodies of copper-bearing ore which nourish them.

From 1880 to 1910, copper mines in Arizona were of the "bonanza" or high-grade type. Such properties as the Old Dominion at Globe, the Copper Queen at Bisbee, the United Verde at Jerome, and those at Clifton-Morenci were the major producers during this



Copper Mining About 1900

period. Beginning about 1910 and through the next 50 years, the low-grade "porphyries" were the chief copper producers. The Magma Mine at Superior has been a high-grade producer since 1910, and is still operating as such. The United Verde Extension Mine at Jerome was another high-grade producer that operated from 1916 to 1938. The Copper Queen at Bisbee is still producing a sizable amount of copper. The United Verde at Jerome was exhausted in 1952.

In 1959, the copper mining and smelting industry payroll in Arizona amounted to \$80,534,236, in a year which saw over half the industry shut down by a strike that lasted throughout the last five months. The average weekly earnings of those employed in the Arizona copper mines and smelters were higher than the national average for non-ferrous mines and higher than for any other industry in the state. These statistics do not include fringe benefits which are adding over 25 percent to the annual labor cost of the copper mining and smelting industry.

Arizona copper mines spent over \$30,000,000 in Arizona for

in the following years, due to technical problems connected with its use, but for three years beginning with 1951, production averaged 2,000 tons annually with a value of \$13,000. The U. S. Bureau of Mines reported perlite production from 1954 to 1957 inclusive, totalling 42,179 tons valued at \$305,396.

Production was not reported in 1958 and 1959, but the 1958 production dropped below the 1957 value of \$114,000. This was due largely to the closing of the Superior Industries, Inc., and Lee's Perlite Industries, Inc. operations in Pinal County. The principal producer in 1958 was Perlite Industries, Inc., which shipped crude perlite to Sil-Flo Corporation, Fort Worth, Texas, and also consumed 600 tons at its Phoenix expanding plant.

Production increased in 1959 and perlite popping plants were operated at Phoenix (Perlite Industries) and at Tucson by Tucson Perlite, Inc.

PUMICE

Pumice and pumicite (volcanic ash), used mainly as an aggregate for making concrete blocks, have come into prominence only since 1951. For the last seven years, the U. S. Bureau of Mines reported a production of 1,700,000 tons worth \$4,100,000.

Material classified as pumice in 1959 consisted entirely of volcanic cinder (scoria) and total output reached 487,000 tons with a value of \$1,153,000. The use of scoria as railroad ballast accounted for 57 percent of the total, followed closely by concrete aggregate (42 percent). The Santa Fe Railroad operated its cinder pit in Coconino County and was the principal producer. San Xavier Rock & Sand Company in Cochise County, Harenburg Block Company, Inc., Superlite Builders Supply Company in Coconino County, and Gila Cinder Company, in Graham County were the other operators.

MISCELLANEOUS NON-METALLICS

Barite, diatomaceous earth, feldspar, fluorspar, gypsum, nitrogen compounds, and silica have been or are being produced in commercial quantities in Arizona. Also gem stones.

various colors is quarried near Ash Fork, Seligman and Drake. Granite rock for building and monumental purposes has been quarried in several Arizona localities, chiefly near Prescott, Phoenix, Casa Grande and Salome. Volcanic tuff is a popular building stone and has been quarried in Cochise, Gila, Maricopa, Mohave, Pima and Yavapai Counties.

Marble was quarried many years ago in the Chiricahua Mountains of Cochise County. Onyx Marble has been produced in Cocino, Maricopa, Pima and Yavapai Counties.

No slate has been produced commercially in Arizona.

Crushed stone, used for concrete, road material, railroad ballast, and smelter flux, has been the chief source of income for Arizona stone producers.

The Arizona Bureau of Mines estimates the value of stone produced in Arizona from 1889-1948 to be \$14,234,000. From 1949 to the end of 1954, Arizona produced 1,493,323 tons of stone worth \$1,764,958, and from 1955 to 1959 production totalled 9,321,000 tons valued at \$14,514,000. This tremendous increase continued in 1960 with preliminary U. S. Bureau of Mines production figures of 2,500,000 tons valued at \$4,000,000. The total recorded value (1889-1960) is \$34,513,000.

MICA

The mica produced in Arizona has been of the scrap variety. Four operators in Maricopa, Mohave, Pima and Yuma Counties have accounted for most of it. Although some mica has been produced for many years, no published records were available before 1953. Arizona mica production from 1953 to 1959 inclusive, according to U. S. Bureau of Mines reports, was 13,192 tons valued at \$238,385.

PERLITE

Perlite deposits near Superior first became of interest in 1924, and commercial production commenced in 1946. The production from 1946 to the end of 1948 was estimated by the Arizona Bureau of Mines to be worth \$65,000. There was a decline in production

Arizona grown or manufactured supplies and equipment in 1960, thus contributing substantially to the larger cities where supply and machinery headquarters are located.

The mining industry is Arizona's largest taxpayer. An annual average of \$20,046,000 was paid for property and production (sales) taxes within the state during the six year period, 1955 to 1960. No other industry contributes nearly as much in taxes. Mining alone carries about 19.0 percent of the State property and sales tax load.

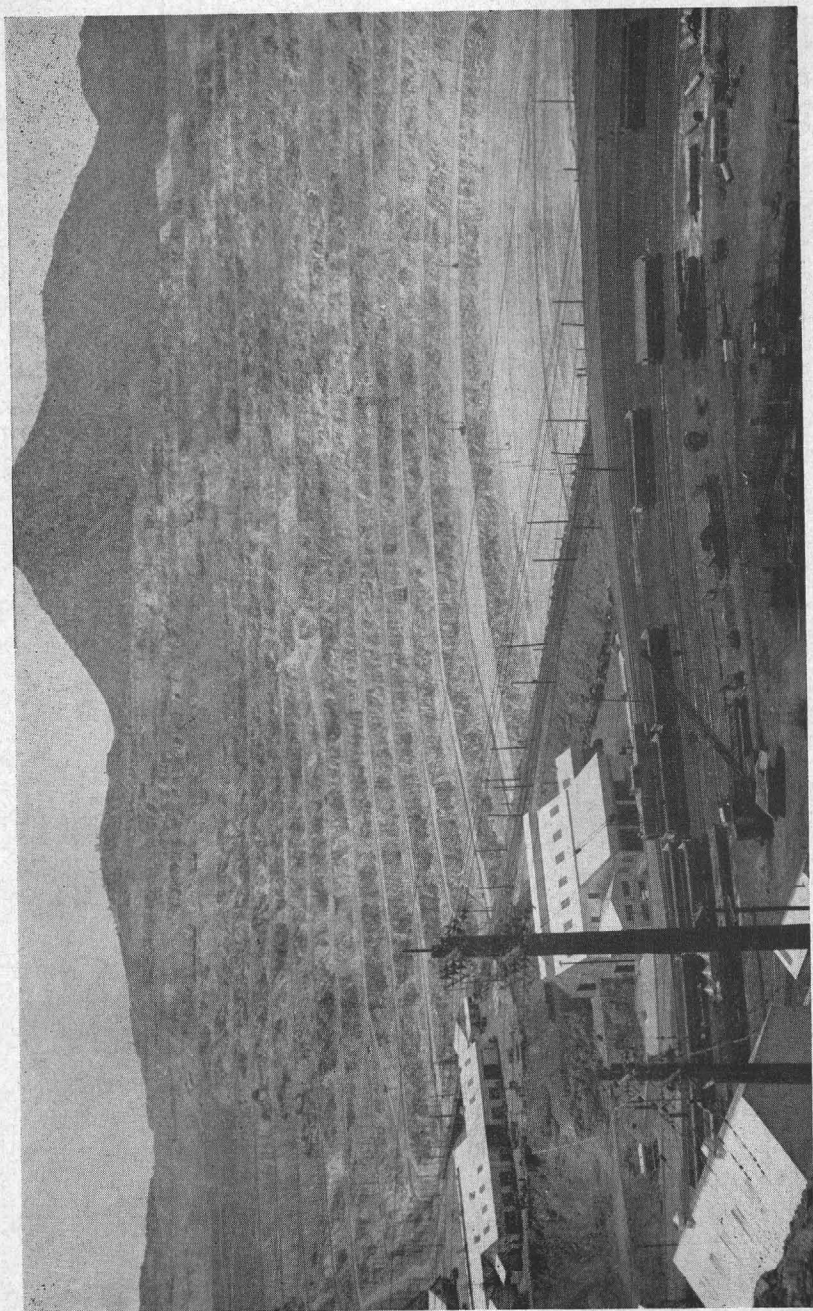
The railroads and truck lines receive a large volume of business through the movement of copper ores and metal as well as supplies and equipment. Copper mining brought the railroads to Arizona and has furnished the bulk of the freight which has kept them going and expanding.

Agricultural, lumber and livestock producers in non-mining portions of Arizona derive a large share of their income from the copper industry.

The copper companies are heavy purchasers of electrical power which is generated at irrigation storage dams. The large power purchases by the copper mining companies have made cheaper power and increased water supply for agriculture and industry.

The copper mining industry has a vital and far reaching effect on the State's economy and is one of the few industries which create new and indestructible wealth. It is equally vital to the nation's security, and it is necessary that this country keep its domestic mines in operating condition at all times.

Copper ores and minerals are of no practical value until they have been converted into metallic copper. They earn no interest, furnish no employment, produce no benefits to anyone. An active mining industry is the agency which converts them into tangible assets and, in the process of conversion, the benefits derived therefrom are distributed widely among other industries and businesses. The direct and indirect beneficiaries of the copper industry are countless. It has been estimated that an average of 13.5 persons (including the miner himself) is dependent upon each mine and smelter employee's wages.



Open Pit Copper Mine

has been used in the flotation process at large copper concentrators, and most of this has come from the Paul Lime Plant at Paul's Spur in Cochise County, and from Hoopes & Company, in Gila County. Some mills have been making their lime from limestone quarried at their copper properties.

The Arizona Bureau of Mines has estimated the value of lime produced in Arizona from 1894-1948 to be \$12,046,000. From 1949 to the end of 1960, the value of lime produced was \$15,859,000, making the total value since the beginning of production 28 million dollars.

CLAYS

Clays have been produced in Arizona since 1894. A white bentonite or bleaching clay from open pits near Sanders, Apache County, has been of chief importance. Other bentonite clays have been marketed and bricks and miscellaneous clay products have been produced in Maricopa and Pima Counties.

Production value to the end of 1960 is estimated to have been over \$22 million.

SAND AND GRAVEL

Sand and gravel are products of all States in the Union and Arizona is no exception. Records of production were first reported statistically in 1917, and the Arizona Bureau of Mines reports the production from 1917 to 1948 inclusive to have been worth \$15,668,000. The U. S. Bureau of Mines reports the Arizona production for the period 1949 to 1954 inclusive to have been 15,423,000 tons worth \$11,770,532, and for 1955 to 1959, 61,640,000 tons with a value of \$43,400,000, an increase of nearly 400 percent. Preliminary figures for 1960 are 12,135,000 tons with a value of \$11,183,000, making the total for 1917 to 1960, \$82,021,000.

STONE

Commercial stone is broadly classified as dimension stone, slate, and crushed stone. Dimension stone is used in buildings, walls, pavements, curbs, flagging and ornaments.

Commercial shipments of sandstone have been made from Coconino, Navajo and Yavapai Counties. Coconino sandstone of

of several asbestos companies searching for, and finding, new markets for their products. Most Arizona asbestos is short fiber, grading through crudes No.'s 4 to 7. Only a very small percentage is longer fiber, high priced No.'s 1, 2 and 3. The very low iron content of the Gila County chrysotile makes it eminently suitable for electrical insulation uses.

These Arizona deposits once were the only low-iron chrysotile deposits known in the Western Hemisphere, but now the Cassiar deposit in British Columbia is a strong competitor. It is cheaper to mine but Arizona has advantageous transportation cost and lower iron content.

The asbestos companies who now have modern fiberizing mills are Metate Asbestos Corporation, Jaquays Mining Corporation and Le Tourneau Asbestos Company. Other active mills are those of Roger Kyle and Guy Phillips. All of these mills are at Globe, except the Phillips which is near Seneca.

Total production in Arizona is roughly estimated at 39,000 tons with a value of \$10,600,000.

Since 1944, production figures have been confidential excepting data regarding Government Purchases from 1952 to 1958. In October, 1952, the General Services Administration opened an asbestos purchasing depot at Globe, and this resulted in the opening and re-opening of a number of asbestos properties. The largest of these were the Regal, Phillips, Crown, Chrysotile and Rock House.

The total asbestos purchases by the General Services Administration from 1952 to 1958 were:

	Tons	Value
Nos. 1 and 2 Crude	3,240	\$3,845,314
No. 3 Crude	1,897	758,424

In 1960, G.S.A. contracted for purchase of 500 tons of No. 2 Crude for the National Stockpile at \$918.30 per ton.

LIME

Lime for building purposes has been produced in Arizona since 1894. Since 1915, the larger proportion of the lime produced

In the past four decades the average grade of copper ore in Arizona has been steadily declining from a content of 50 pounds per ton of ore to less than 18 to 20 pounds per ton. This, together with steadily increasing wages, which have quadrupled during the same period, naturally leads to higher production costs, in spite of technological improvements in mining and metallurgy.

Threat of Imports

From 1932 to 1940, Congress imposed and re-imposed a 4-cent copper tariff every two years. The price of copper averaged 10.11 cents per pound in this period, so that on an ad valorem basis the duty was roughly 40 percent. Cutting the ad valorem tax from 40 percent to 12½ percent would still permit a 4-cent tariff in a 32-cent copper market. This 68.75 percent tariff reduction should satisfy the low-tariff advocates. Nevertheless, the present tax is only 1.7 cents per pound of copper, which means that the ad valorem tax is only 5.3 percent of a 32-cent copper price, and amounts to an 86.75 percent cut.

New Developments

Arizona has attained a copper production capacity of over 600,000 tons of copper per year, but the producers are continuing the search for new ore-bodies to keep up with the expanding demand for the metal and for improved methods of extracting copper from their deposits. Kennecott Copper Corporation has recently expended over forty-million dollars in increasing their ore production at Ray by fifty percent. The company has also purchased 120 claims north and east of Safford where drilling has discovered a large copper mineralized area. Phelps Dodge Corporation has been exploring and acquiring property nearby.

The American Smelting & Refining Company has completed a 5-year exploration program at its Mission Project, 15 miles southwest of Tucson, and is spending \$43.5 million in order to mine and process 15,000 tons of ore per day. An annual output of 45,000 tons of copper is expected after 1961.

Inspiration Consolidated Copper Company plans to be producing at the rate of 18,000 tons of copper annually from its Christmas property in Gila County by 1962.

Additional output of copper is expected soon from the Banner and Pima companies in Pima County.

Duval's Esperanza Mine in Pima County began production of copper in March, 1959, treating 12,000 tons of ore a day, a rate expected to yield an annual output of about 25,000 tons of copper.

The major copper producing mines and smelters in Arizona in 1960 are listed in Table III.

TABLE III
MAJOR ARIZONA COPPER MINES, 1960

Open Pit			
Mine	County	Operator	Tons Ore Mined
Morenci	Greenlee	Phelps Dodge Corp.	14,499,800
New Cornelia	Pima	Phelps Dodge Corp.	9,065,600
Ray	Pinal	Kennecott Copper Corp.	6,526,814
Inspiration	Gila	Inspiration Cons. Copper Co.	5,314,770
Esperanza	Pima	Duval Sulphur & Potash Co.	4,245,762
Lavender Pit	Cochise	Phelps Dodge Corp.	4,248,400
Copper Cities	Gila	Miami Copper Co.	3,058,372
Silver Bell	Pima	Amer. Smelting & Refining Co.	2,718,700
Bagdad	Yavapai	Bagdad Copper Corp.	1,828,055
Pima	Pima	Pima Mining Co.	1,327,473
Total Tonnage			52,833,746
Underground			
San Manuel	Pinal	San Manuel Mining Co.	12,261,220
Magma	Pinal	Magma Copper Co.	386,636
Copper Queen	Cochise	Phelps Dodge Corp.	509,700
Mineral Hill & Daisy	Pima	Banner Mining Co.	48,872
Miami	Gila	Miami Copper Co.	*
Total Tonnage			13,206,428

There are 8 copper smelters, 1 each at Morenci, Ajo, Douglas, San Manuel, Superior and Miami, and 2 at Hayden (Kennecott's and Asarco's). Inspiration Consolidated Copper Company operates an electrolytic refinery at Inspiration, in addition to its smelter at Miami.

*Underground mining discontinued June 26, 1959.

RARE METALS

Of the 92 chemical elements of which the earth is composed, 68 may be classed as metals. Perhaps half of these are commercially important although only about 20 are used now.

It has been said that development of metals got an impetus during the war that would have taken 50 years of peacetime effort to accomplish. Many new uses for metals and new alloys have passed the experimental stage, and many more will be discovered. That statement applies particularly to the more obscure metals, the newcomers to important industrial use. Among these are lithium, germanium, indium, columbium, beryllium, tantalum, thorium and uranium.

The term "rare metals" is often a misnomer insofar as it may imply scarcity. Uranium and lithium are more widespread in the earth's crust than is zinc; thorium than lead; and beryllium and rubidium than tin. Indeed, spectographic analyses of rocks and minerals are demonstrating that many so-called rare elements are rare only in the sense that they are neither well known nor easily recognized. Today's tremendous advances in technology are calling more and more for new substances having special qualities. Singly or in combination, these unfamiliar elements are now important articles in every day use. Arizona now produces substantial amounts of uranium. Because of its varied and widespread mineralization, this state could easily become an important source for more of these rare elements.

NON-METALLIC MINERALS

ASBESTOS

Today the asbestos producers of Central Arizona are again producing the high grade, low-iron content fiber for which they are famous.¹ The depression picture that gripped the Arizona asbestoc industry after December 31, 1958, when the U. S. Government stopped purchases of fiber under Public Law 733, has changed to one of new activity. Three new processing mills, with new equipment, have been erected as a result of the aggressive leaders

1. Mining World, September, 1960, pages 44-45.

MERCURY

Quicksilver deposits have been worked in the Dome Rock Mountains near the western boundary of Arizona; in Copper Basin, southwest of Prescott; in the Phoenix Mountains; and in the Mazatzal Mountains, north of the Roosevelt Dam. Up to 1928, none of these had reported appreciable production. At best, the yield to then probably had not exceeded a few hundred 75 pound flasks, (say 500 with a value of \$37,500). U.S.B.M. records from 1928 through 1946 indicate a production of 9,000-76 pound flasks worth about \$1,200,000. The production from 1947 through 1953 was practically nil. From 1954 through 1960, mercury production in Arizona amounted to about 1,500-76 pound flasks worth about \$400,000. This makes a total Arizona production of about 10,500 75-76 pound flasks worth about \$1,500,000.

VANADIUM

One of the important uses of vanadium is in the production of high quality steels. The total value of vanadium that has been produced in Arizona is estimated at one million dollars. Prior to 1945 it was obtained largely from complex ore operations in the Mammoth District in Pinal County, but more recently it has been recovered from uranium ores of the northeastern part of the State. The U.S. Bureau of Mines does not report the quantity or the value of Arizona's production.

IRON

The development of iron ore in Arizona is a long-range prospect, with many problems to solve. However, the production of metallic iron from copper slag dumps is well within the range of early development.

Exploration by the Colorado Fuel and Iron Company in the Apache Reservation gives promise of developing iron ore in commercial quantities in the near future.

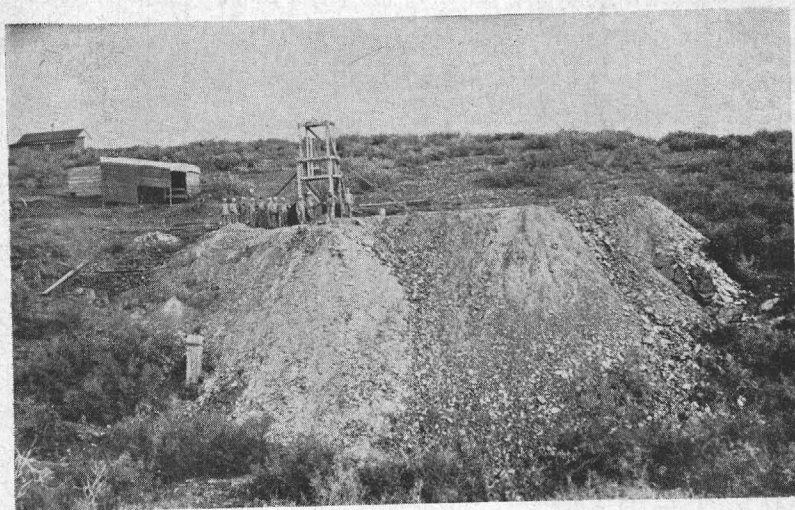
A small 75-ton steel plant, developed by J. D. Madaras has been constructed near Coolidge, Arizona, and will be used to treat concentrate from a black sand (magnetic iron) deposit located between Florence and Oracle Junction.

LEAD AND ZINC

The production of lead in Arizona was first reported statistically by the Arizona Bureau of Mines in 1894 and that of zinc in 1905. However there are records of actual production of both metals prior to that time. For example, some lead was mined in the Bisbee or Warren District prior to 1880. Some silver-lead ore was shipped from 1882 to 1893 from the San Xavier, Fortuna, Banner, Chloride and other mines of the Pima District. Mineral deposits, including lead carbonate and other silver-lead ores, were discovered in the Aravaipa District before 1880. In the Mammoth (St. Anthony) District production of lead or zinc was not reported until 1934, though silver and gold had been shipped from the district as early as 1880. The Johnson Camp Area in Cochise County had been worked as a source of copper ores from 1881, but it was not until 1942 that zinc concentrates were produced. Likewise the Magma (Superior) District saw the famous Silver King Mine discovered in 1873, but it wasn't until 1916 that the Magma Mill treated lead-zinc ores. The Big Bug District in Yavapai County had its first production of gold and silver and a little copper in 1906, but it did not begin to produce lead and zinc until 1938. The Seventy-Nine lead deposit in the Banner District, was first located in 1879 but the record of its production of lead and zinc began in 1913.

The Arizona Bureau of Mines reports the production of the Harshaw, Patagonia, Palmetto, Tyndall, Wrightson and Oro Blanco Districts in Santa Cruz County from 1858 to 1933 to have been approximately 19,500 tons of copper, 25,000 tons of lead, \$1,315,000 in gold and \$4,637,000 in silver. The oldest mine is the Mowry, which from 1858-1930 produced 5,000 tons of lead and \$500,000 in silver. Another property was the Duquesne, which from 1899-1925 produced 7,500 tons of copper, 6,000 tons of lead, and \$350,000 in silver.

Three mines in the Harshaw District, the Flux, Hardshell and Trench produced from 1880-1925 a total of 5,500 tons of lead and \$430,000 in silver. The Montana Mine (Goldfield Cons. 1917-18) (Eagle Picher, 1927-30) in the Oro Blanco District produced 3,900 tons of lead and \$393,000 in gold and silver. The Montana Mine, operated by the Eagle-Picher Mining Company ranked as the largest producer of lead and zinc in Arizona from 1935 to 1939 inclusive.



Early Lead-Zinc Mine

The Iron King Mine (Yavapai County) has been the principal lead and zinc producer in recent years, with an output in 1959 of 7,251 tons of lead and 17,419 tons of zinc. The Flux and the Glove Mines in Santa Cruz County and the San Xavier in Pima County, supplied most of the remaining lead output. The Old Dick Mine was reopened by Cyprus Mines Corporation at the beginning of 1959 after a year of inactivity. It operated throughout the year, and became the State's second largest zinc producer. Other major zinc-producing mines, in order of descending 1959 output, were the Atlas, Flux, San Xavier and Johnson Camp (Moore Shaft). The San Xavier and Glove Mines are now idle.

Arizona's average annual production of lead and zinc is shown in Table IV.

TABLE IV

	Tons Lead Produced Annual Rate	Tons Zinc Produced Annual Rate
1894-1910	2,075	1,045*
1911-1935	6,376	2,678
1937-1941	12,520	9,900
1942-1946	18,400	30,233
1947-1952	25,388	56,734
1953-1959	10,566	28,145

*Annual Rate from 1905-1910.

0.35 percent (7.0 pounds per ton) U_3O_8 compared to a similar estimate of Dec. 31, 1958, of 1.4 million tons averaging 0.34 percent (6.8 pounds per ton) U_3O_8 .

Uranium production from July 1, 1955 to the end of the year 1959, totalled 6,473,000 pounds of U_3O_8 obtained from 1,164,000 tons of ore and valued at \$27 million. Production figures for 1958 and 1959 are given in Table VII.

TABLE VII
URANIUM PRODUCTION IN ARIZONA IN 1958 AND 1959

County	1958				1959			
	No. of Properties	Ore (Short Tons)	Lbs. U_3O_8 (1000's)	F.O.B. Mine Value (1000's)	No. of Properties	Ore (Short Tons)	Lbs. U_3O_8 (1000's)	F.O.B. Mine Value (1000's)
Apache	30	112,364	650.0	\$2,723	16	85,384	446	\$1,846
Navajo	6	75,434	484.4	2,076	11	114,028	661	2,707
Coconino	46	69,222	510.3	2,234	37	53,956	406	1,756
Gila	—	—	—	—	—	—	—	—
Undistributed	4	736	3.9	16	2	22	0	0
TOTAL	86	257,756	1,648.6	\$7,049	66	253,390	1,513	\$6,309

MISCELLANEOUS METALS

TUNGSTEN

Arizona has been producing a small amount of tungsten ore since 1910. The total ore production for the years 1910 to 1959 was 4,581 short tons with total value of \$6,337,000.

Tungsten mining has received little encouragement from the government since 1956. The base price paid by the government, under the Defense Production Act of 1950, for concentrate produced in the United States was \$63 per short-ton unit of WO_3 until about June 1, 1956, when purchase of the authorized 3 million short ton units was virtually completed. Public Law 733, passed by the 84th Congress in July 1956 authorized the purchase of an additional 1,250,000 units at \$55. However the appropriated \$15 million was exhausted by early December, 1956. Congress has refused to appropriate more and the complete shut-down of Arizona tungsten mines in middle 1957 still continues.

Mexican manganese ore and concentrates to the Kaiser Steel Corporation plant at Fontana, California, under a contract negotiated in 1958.

The recorded Arizona production of 35 percent or better manganese ore prior to the establishment of the Wenden Depot in 1953, as reported by the U.S. Bureau of Mines, totals 75,000 long tons with a value of \$1,956,000. Practically all of this was produced during World Wars I and II.

A summary of Arizona production is given in Table VI.

TABLE VI

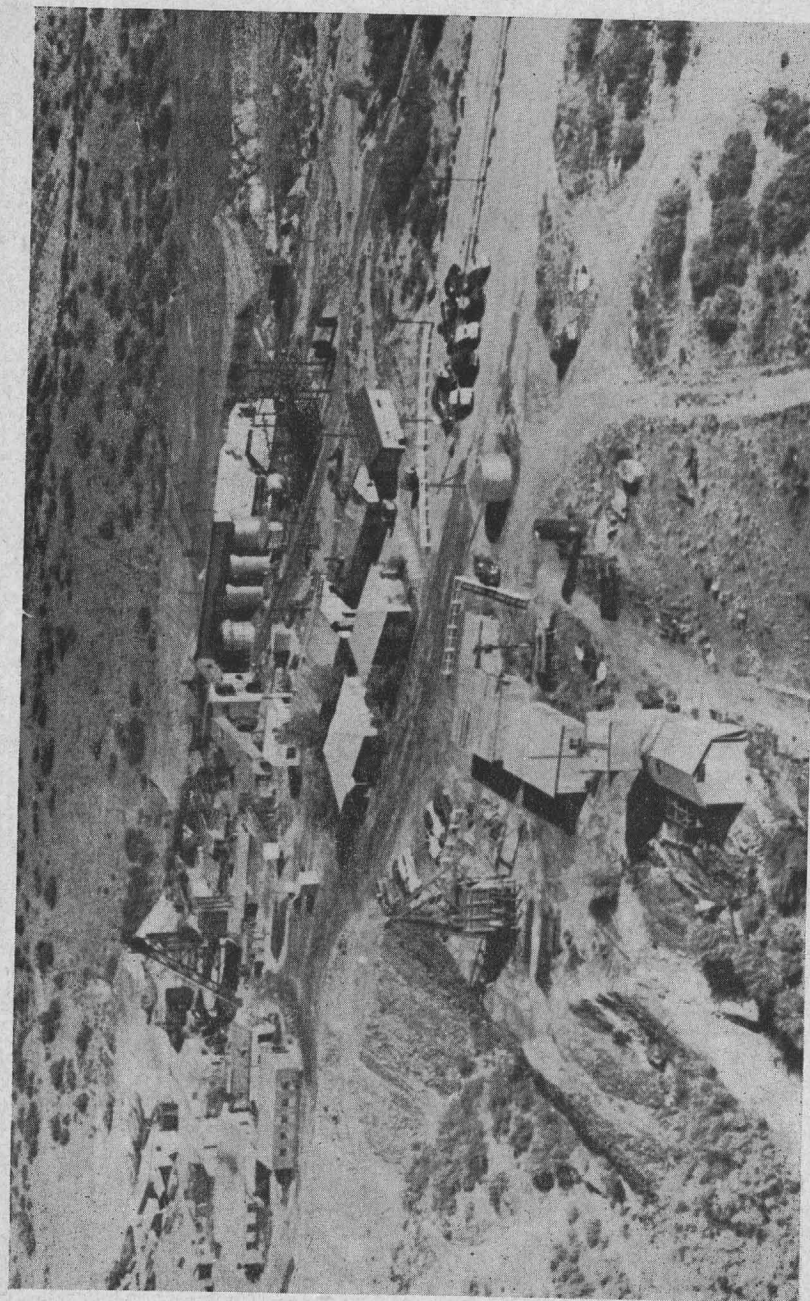
Manganese Ore and Concentrates			
	Long Tons (Approx.)	Value (Approx.)	Per Ton (Approx.)
Years 1915-1952	75,000	\$ 1,956,000	\$26.00
Wenden—Years 1953-1954	152,000	10,743,000	70.00
Carlot— Years 1955-1959	262,000	21,591,000	82.25
Total	489,000	\$34,290,000	\$70.12

URANIUM

Considerable prospecting has been done in Arizona for uranium during the last ten years, and discoveries of uranium bearing minerals have been made in all fourteen counties of Arizona. With few exceptions, operating mines are located in the Colorado Plateau in the northeast section of the State. By far the greater number of deposits are in the Mesozoic sedimentary formations. Properties in the Globe area, in Yavapai County, and in Yuma County near the Bill Williams River, are not producing. Ores in the Globe area are refractory and from these last three regions transportation to the nearest, and only Arizona uranium plant, at Tuba City, is costly.

In 1959, uranium-ore production was reported from 66 operations compared with 86 in 1958. The grade of ore produced declined from 0.32 percent (6.4 pounds) to 0.30 percent (6.0 pounds) U_3O_8 per ton.

The uranium-ore reserve as determined by the Atomic Energy Commission (AEC) on Dec. 31, 1959 was 1.2 million tons averaging



Same Lead-Zinc Mine About 50 Years Later

Before the year 1947, because of the failure of foreign producers of lead and zinc to furnish our domestic needs, Arizona was encouraged to open up and develop its lead-zinc mines. In 1949 it attained a production of 33,568 tons of lead and 70,658 tons of zinc from a total of 181 mines. A flood of lead and zinc imports from 1952 to 1959 caused metal prices to collapse and over 100 mines were compelled to shut down. Only one large lead-zinc mine (the Iron King) was able to operate continuously from 1952 through 1959, and this mine had been kept going only because of its income from gold, silver and copper by-products.

Table V compares the two periods, 1947-1952 and 1953-1959.

TABLE V

	1947-1952	1953-1959
Avg. tons lead produced per year (Ariz.)	25,388	10,566
Avg. tons zinc produced per year (Ariz.)	56,734	28,145
Avg. price of lead (U.S.) (c per lb.)	15.891	13.953
Avg. price of zinc (U.S.) (c per lb.)	14.052	11.498
Avg. tons lead imported per year (U.S.)	400,391	415,769
Avg. tons zinc imported per year (U.S.)	493,892	701,409
Avg. number Arizona lead-zinc mines	155	39

MOLYBDENUM

The metal molybdenum, used as an alloying metal in the steel industry, is beginning to rank with gold and silver as a valuable by-product of Arizona copper ores. The chief mineral of molybdenum is molybdenite (MoS_2). The Miami Copper Company has been a regular producer of molybdenum concentrates since 1938. They are recovered as a by-product at Miami, Arizona, and are converted to molybdic oxide at the same location.

Wulfenite (lead molybdate, PbMoO_4) was mined from 1916 to 1944, in the Mammoth District in Pinal County.

The metal molybdenum was in short supply in 1951, and the Government took steps to increase production. In addition to Miami, the Morenci and Bagdad mines developed a method of re-

covering the mineral from their copper ores in 1951. The Silver Bell, San Manuel and Esperanza mines also have become important producers of molybdenite.

Arizona's recorded production of molybdenum from 1916 to 1959 inclusive is 33,456,000 pounds with a value of \$31,038,000. In 1951 the production was 1,173,000 pounds, more than the entire period from 1916 to 1934. 1960 preliminary molybdenum production was 4,314,000 pounds valued at \$5,413,000, and was 80 percent above the previous high year of 1956.

MANGANESE

Low grade manganese ore occurs in Arizona in a tonnage estimated by the United States Geological Survey at 200,000,000 tons of about 4% manganese. It is not visionary to predict utilization of this ore in the future when one remembers that the United States is largely dependent upon foreign sources for its manganese.

Government purchase of manganese ore from 1953 to 1955 resulted in the stockpile at Wenden, Arizona of ores containing 6,108,316 long-ton units of recoverable manganese. The cost to the Government was \$10,743,179. This ore will have to be up-graded before it is usable in the steel industry. It now contains less than 20 percent manganese.

Under a later carlot program, additional Government purchases of Arizona manganese ore and concentrates totalled 262,205 long tons with a value of \$21,591,410. For 1959, the United States Bureau of Mines reported that Arizona production of manganese ore and concentrates totalled 78,876 long tons with a value of \$5,961,000. Production was reported from 82 mines in 9 counties. Yuma and Maricopa counties were the largest producers, followed by Pinal, Pima, and Mohave. The quota on the carlot program was reached, and purchase of ore for the Government stockpile was halted on August 5, 1959. Arizona's manganese industry came to a near standstill. Mohave Mining and Milling Company, the State's largest producer and operator of a manganese mill and sintering plant at Wickenburg announced its decision to liquidate the company. Throughout the year, this company supplied domestic and